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BRITISH ASSOCIATION SCRAPS.

IN a paper read before the Mathematical and Physical section, Professor Chandler Roberts remarked on the rapid diffusion of molten metals. The two metals chosen were lead and gold enclosed in a U-shaped tube, the lead occupying the lower portion of the tube, and the gold being put in at the top of one limb. After about forty minutes Professor Roberts found that the two metals had been thoroughly mixed. Sir W. Thomson called attention to the extreme importance of this, with reference to metallic alloys, and remarked that it resembled the diffusion of gases or of heat in a gas rather than of a solid in a liquid. Salt would take years to diffuse in a similar manner through water.

A PAPER was read which had been received from two American gentlemen, Messrs. W. B. Scott and H. F. Osborne, upon the "Origin and Development of the Rhinoceros Group." These gentlemen have made careful researches in the extensive series of tertiary lake deposits in the North-Western United States, in which specimens of very many animals have been discovered, which render it possible satisfactorily to trace the genealogy of several important groups of mammals. These gentlemen have discovered the remains of the ancestor of the rhinoceros group—an ancestry from which it is found that both the rhinoceros and the tapir groups are descended. This animal has been named Orthocynodon. A somewhat detailed account of the anatomy of the skull and form of dentition was given, bearing out the authors' views.

THE committee on Meteoric Dust state that Mr. Pope Hennessy had obtained a quantity of ice and snow from the Himalayas. After being melted and boiled down the residue was sent to England for examination. In most specimens of the dust are a number of small spherical bodies of magnetic matter, the surfaces of which are generally highly polished. Dr. Schuster showed several of these particles, the largest being perhaps one-twentieth of a millimètre in diameter, which had been obtained from a spot in the Himalayas about 3,400 ft. high and 14 miles from any human habitation.

SIR R. W. RAWSON stated that, according to the observations of the Anthropometric Committee, it appeared that from the top of the social scale to the bottom there was a gradual descent in stature, weight, chest-girth, and all the elements of strength. It was therefore of the utmost importance that by nurture and improvement of sanitary conditions the lowest should be raised to the level of the highest.

DR. SCHUSTER read an interesting paper on the motion of the Swiss glaciers. It has been known for some time that there are long periods of time during which the Swiss glaciers advance down or recede up their beds. Thus, in 1741, they were advancing, but it was reported that in 1700 it was possible to walk from Chamounix to Courmeyer over the Col de Géant without touching ice. They advanced all last century as far as is known and up to 1817, then went back until 1840, advanced till 1859, and have since been receding till the present year, when many, including the Mer de Glace and the Rosenlaui glacier, have begun to advance. Dr. Schuster has made observations this summer on the Glacier des Boissons, at Chamounix, and has arrived at the important conclusion that the rate of motion of the same point on a glacier changes greatly from day to day. Thus he showed that while during the day the hourly rate of motion of one point observed was only ·6 centimètres, during the next night it advanced at the rate of 5·5 centimètres per hour. The rate of other points examined varied, but not so greatly. Dr. Schuster also noticed the change occurring at the foot of the glacier when it comes into the valley. The downward motion of this point is determined by the fact that the parts above advance more quickly than the ice at the foot melts away. He found that on one side of the glacier, where it rested against a boulder, there was no apparent change in the outline of the ice or in the position of the boulder during the day, while at the other side the end had moved in the same time four or five feet.

A PAPER was read by Mr. E. B. Poulton on heredity in cats with an abnormal number of toes. The peculiarity appeared in the third generation and in succeeding generations. All varieties between the normal four and the extreme seven toes had been observed. The females most frequently possessed the abnormal number of toes. They were very clever at catching mice, and readily learnt to shake hands. The President said the importance of such observations lay in their bearing on heredity. Reasons had been advanced to show that man was descended from a six-fingered animal. Miss Buckland said she had seen in Bath a cat with seven toes on each foot. Professor Marshall remarked on the importance of such observations in relation to investigations as to the origin of species.

MR. ADAM SEDGWICK gave an account of the Periodatus—a slug-like animal which he found in South Africa, and of which he exhibited specimens. The animal, he said, had only recently been discovered, and he made a special visit to the Cape to obtain specimens. Special interest attached to it, as it had no living relations in the animal kingdom. It was a survival of a type of animal which at some ancient time in the world's history was represented by a greater number of forms. The animal lived in the roots of rotten trees, and it had probably survived on account of its habits and the difficulty of finding it. Since its first discovery the animal had been found in New Zealand, South America, and other parts of the world.

XUM

THE BIRTH AND GROWTH OF MYTH.

By Edward Clodd.

XVII.

BEFORE bringing this series of papers to an end, it may be well to give an illustration or two of the survival of myth in historical narrative.

For proofs of the emergence of the higher out of the lower in philosophy and religion, to say nothing of less exalted matters, whether the beast-fable or the nursery rhyme as holding barbaric thought in solution, examples have necessarily been drawn from the mythology of past and present savage races. But these are too remote in time or standpoint to stir other than a languid interest in the reader's mind; their purpose is served when they are cited and classified as specimens. Not thus is it with examples drawn nearer home from sources at which our young thirst for the stirring and romantic was slaked. When we learn that famous names and striking episodes are in some instances only transformed and personified natural phenomena, or, as occurring everywhere, possibly variants of a common legend, the far-reaching influence of primitive thought comes to us in more vivid and exciting form. And although one takes in hand this work of disenchantment in no eager fashion, the loss is more seeming than real. Whether the particular tale of bravery, of selflessness, of faithfulness, has truth of detail, matters little compared with the fact that its reception the wide world over witnesses to human belief, even at low levels, in the qualities which have given man empire over himself and ever raised the moral standard of the race. Moreover, in times like these, when criticism is testing without fear or favour the trustworthiness of records of the past, whether of Jew or Gentile, the knowledge of the legendary origin of events woven into sober history prepares us to recognise how the imagination has fed the stream of tradition, itself no mean tributary of that larger stream of history, the purity of which is now subject of analysis. As a familiar and interesting example let us take the story of William Tell.

Everybody has heard how, in the year 1307 (or, as some say, 1296) Gessler, Vogt (or governor) of the Emperor Albert of Hapsburg, set a hat on a pole as symbol of the Imperial power, and ordered every one who passed by to do obeisance to it; and how a mountaineer named Wilhelm Tell, who hated Gessler and the tyranny which the symbol expressed, passed by without saluting the hat, and was at once seized and brought before Gessler, who ordered that as punishment, Tell should shoot an apple off the head of his own son. As resistance was vain, the apple was placed on the boy's head, when Tell bent his bow, and the arrow, piercing the apple, fell with it to the ground. Gessler saw that Tell, before shooting, had stuck a second arrow in his belt, and, asking the reason, received this for answer: "It was for you; had I shot my child, know that this would have pierced your heart."

Now, this story first occurs in the chronicle of Melchior Russ, who wrote at the end of the fifteenth century, *i.e.*, about one hundred and seventy years after its reputed occurrence. The absence of any reference to it in contemporary records caused doubt to be thrown upon it three centuries ago. Guillimann, the author of a work on Swiss Antiquities, published in 1598, calls it a fable, but subscribes to the current belief in it, because the tale is so popular! The race to which he belonged is not yet extinct. A century and a half later, a more fearless sceptic, who said that the story was of Danish origin, was condemned by the Canton of Uri to be burnt alive, and in the well-timed absence of the offender, his book was ordered to be burnt by the common hangman. But the truth is great, and prevails. G. von Wyss, the Swiss historian, has pointed out that the name of Wilhelm Tell does not occur even once in the history of the three cantons, neither is there any trace that a "Vogt" named Gessler, ever served the house of Hapsburg there. Moreover, the legend does not correspond to any fact of a period of oppression of the Swiss at the hands of their Austrian rulers.

"There exist in contemporary records no instances of wanton outrage and insolence on the Hapsburg side. It was the object of that power to obtain political ascendancy, not to indulge its representatives in lust or wanton insult," and, where records of disputes between particular persons occur, "the symptoms of violence, as is natural enough, appear rather on the side of the Swiss than on that of the aggrandising imperial house."*

Candour, however, requires that the evidence in support of the legend should be stated, although it may have little weight with the readers of Knowledge. There is the fountain on the supposed site of the lime-tree in the market-place at Altdorf by which young Tell stood, as well as the colossal plaster statue of the hero himself which confronts us as we enter the quaint village. But more than this, the veritable cross-bow itself is preserved in the arsenal at Zurich!

However, although the little Tell's chapel, as restored, "was opened with a national *fête*, in the presence of two members of the Federal Council, in June last,"† the Swiss now admit in their school-teaching that the story of the *Apfelschusz* is legendary.

Freudenberger, who earned his death-sentence for affirming that the story came from Denmark, was on the right track, for the following variant of it is given by Saxo Grammaticus, a Danish writer of the twelfth century, who puts it as happening in the year 950:—

"Nor ought what follows to be enveloped in silence. Palnatoki, for some time in the body-guard of King Harold (Harold Gormson, or Bluetooth), had made his bravery odious to many of his fellow-soldiers by the zeal with which he surpassed them. One day, when he had drunk too much, he boasted that he was so skilled a bowman that he could hit the smallest apple, set on the top of a stick some way off, at the first shot, which boast reached the ears of the king. This monarch's wickedness soon turned the confidence of the father to the peril of the son, for he commanded that this dearest pledge of his life should stand in place of the stick, adding a threat that if Palnatoki did not at his first shot strike off the apple, he should with his head pay the penalty of making an empty boast. This command forced him to attempt more than he had promised, and what he *had* said, reported by slanderous tongues, bound him to accomplish what he had *not* said. Yet did not his sterling courage, though caught in the snare of slander, suffer him to lay aside his firmness of heart. As soon as the boy was led forth, Palnatoki warned him to await the speeding of the arrow with calm ears and unbent head, lest by any slight movement of the body, he should frustrate the archer's well-tried skill. He then made him stand with his back toward him, lest he should be scared at the sight of the arrow. Then he drew three arrows from his quiver, and with the first that he fitted to the string he struck the apple. When the king asked him why he had taken more than one arrow from his quiver, when he was to be allowed to make but one trial with his bow, he made answer,

* *Edinburgh Review*, January, 1869, p. 134. Article on Rilliet's "Origines de la Confédération Suisse: Histoire et Légende."

† *Times'* telegram from Geneva, June 25.

"That I might avenge on thee the swerving of the first by the points of the others, lest perchance my innocence might have been punished, while your violence escaped scot-free.'" *

Going further northward we find tales corresponding in their main features to the above, in the Icelandic Saga, the Vilkina; in the Norse Saga of Saint Olaf or Thidrik; and in the story of Harold, son of Sigurd. In the Olaf Saga it is said that the saint or king, desiring the conversion of a brave heathen, named Eindridi, competed with him in various athletic sports, swam with him, wrestled with him, and then shot with him. Olaf then dared Eindridi to strike a writing-tablet from off his son's head with an arrow, and bade two men bind the eyes of the child and hold the napkin so that the boy might not move when he heard the whizz of the arrow. Olaf aimed first, and the arrow grazed the lad's head. Eindridi then prepared to shoot, but the mother of the boy interfered and persuaded the king to abandon this dangerous test of skill. The story adds that had the boy been injured, Eindridi would have revenged himself on the king.†

Somewhat like this, as from the locality might be expected, is the Faroe Isles variant. King Harold challenges Geyti, son of Aslak, and, vexed at being beaten in a swimming match, bids Geyti shoot a hazel-nut from off his brother's head. He consents, and the king witnesses the feat, when Geyti

"Shot the little nut away,
Nor hurt the lad a hair."

Next day Harold sends for the archer, and says:—

"List thee, Geyti, Aslak's son,
And truly tell to me,
Wherefore hadst thou arrows twain
In the wood yestreen with thee?"

To which Geyti answers:—

"Therefore had I arrows twain
Yestreen in the wood with me,
Had I but hurt my brother dear
The other had pierced thee."

With ourselves it is the burden of the ballad of William of Cloudeslee, where the brave archer says:—

"I have a sonne seven years old;
Hee is to me full deere;
I will tye him to a stake—
All shall see him that bee here—
And lay an apple upon his head,
And goe six paces him froe;
And I myself with a broad arroe
Shall cleave the apple in towe."

In the *Malleus Maleficarum*, Puncher, a magician on the Upper Rhine, is required to shoot a coin from off a lad's head; while travelling eastwards, as far as Persia, we find the Tell myth as an incident in the poem "Mantic Ultraïr," a work of the twelfth century.

Thus far I have spoken of the variants of the legend found among Aryan peoples, and it is tempting to base upon this diffusion of a common incident a theory of its origin among the Central Asian ancestors of the Swiss and the Norseman, the Persian and the Icelander. But it is found among non-Aryans also. The ethnologist, Castren, whose researches in Finland have secured a valuable mass of fast-perishing materials, obtained this tale in the village Ultuwa. "A fight took place between some freebooters and the inhabitants of the village of Alajärai. The robbers plundered every house, and carried off amongst their captives an old man. As they proceeded with their spoils along the strand of the lake, a lad of twelve years old appeared from among the reeds on the opposite bank, armed with a bow and amply provided with arrows; he threatened to shoot down the captors, unless the old man, his father was restored to him. The robbers mockingly replied that the aged man would be given to him, if he could shoot an apple off his head. The boy accepted the challenge, pierced the apple, and freed his father." Among a people in close contact with an Aryan race as the Finns are in contact with both Swedes and Russians, the main incident of the Tell story may easily have been woven into their native tales. But in reference to other non-Aryan races Sir George Dasent, who has treated of the diffusion of the Tell story very fully in the Introduction to his "Popular Tales from the Norse" (a reprint of which would be a boon to students of folk-lore), says that it is common to the Turks and Mongolians, and a legend of the wild Samoyedes, who never heard of Tell or saw a book in their lives, relates it, chapter and verse, of one of their marksmen. What shall we say, then, but that the story of this bold master-shot was prominent amongst many tribes and races, and that it only crystallised itself round the great name of Tell by that process of attraction which invariably leads a grateful people to throw such mythic wreaths, such garlands of bold deeds of precious memory, around the brow of its darling champion."* Of course the solar mythologists see in Tell the sun or cloud deity; in his bow the storm-cloud or the iris; and in his arrows the sun-rays or lightning darts.

This is a question which we may leave to the champions concerned to settle. Apart from the evidence of the survival of legend in history, and the lesson of caution in accepting any ancient record as gospel which we should learn therefrom, it is the human element in the venerable tale which interests us most.

Remote in time, far away in place, as is its origin, it moves us yet. The ennobling qualities incarnated in some hero (whether he be real or ideal matters not) meet with admiring response in the primitive listeners to the story, else it would have been speedily forgotten. Thus does it retain for us witness to the underlying oneness of the human heart beneath all surface differences.

NOTE.—The totemic illustration in the previous paper was copied from Dorman's "Primitive Superstitions," p 238, and Lubbock's "Origin of Civilisation," p. 52.

THE ELEMENTS.†

THOUGH theoretical and practical chemistry are now intertwined, with manifest advantage to each, they appear to have been far apart in their origin. Practical chemistry arose from the arts of life, the knowledge empirically and laboriously acquired by the miner and metallurgist, the potter and the glass-worker, the cook and the perfumer. Theoretical chemistry derived its origin from cosmogony.

In the childhood of the human race the question was eagerly put, "By what process were all things made?" And some of the answers given started the doctrine of elements. The earliest documentary evidence of the idea is probably contained in the "Shoo King," the most esteemed of the Chinese classics for its antiquity—probably older than Solomon's writings. The elements named are—water, fire, wood, metal, earth. A similar idea of five elements,

* Bk. x., p. 166. Cf. Baring Gould's "Curious Myths," p. 117; and Fiske's "Myths and Myth-makers," p. 4.
† Baring Gould, p. 119.

* Introd. xxxv.
† From Dr. Gladstone's Address, Chemical Section of British Association.

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differently named, was also common among the Indian races before the fifteenth century B.C. The five are curiously correlated with the five senses, and they are not looked upon as independent material existences, but as derived from one another. This philosophy was accepted alike by Hindoos and Buddhists. It was largely extended over Asia, and found its way into Europe. It was best known to us in the writings of the Greeks. Among these people, however, the elements were reduced to four—fire, air, earth, and water—though Aristotle endeavoured to restore the "blue ether" to its position as the most subtle and divine of them all.

For the modern idea we must again travel back to China. In the sixth century B.C. the great philosopher Lao-tse and his disciples founded the religion of Taou. They held that the souls of the five elements—water, metal, fire, wood, and earth—arose and became the five planets. At the beginning of the seventh century the doctrine of Lao-tse was in great favour at the Chinese court. The disciples of Mahomed carried their arms and his doctrines to the Flowery Land. In the eighth century there were frequent embassies between East and West, wars with Caliphs, and a matrimonial alliance. The teachings of the Taouist alchemists penetrated to Arabia.

Geber, a Sabæan, started what to the west was a new philosophy about the transmutation of metals. The idea became gradually clearer that all material bodies were made up of certain constituents, which could not be decomposed any further, and which, therefore, should be considered as elementary. The introduction of quantitative methods compelled the overthrow of mediæval chemistry, and led to the placing of the conception of simple and compound bodies upon the foundation of scientific fact. Lavoisier, perhaps, deserves the greatest credit in this matter, while the labours of the other great chemists of the eighteenth and the beginning of the nineteenth centuries were in a great measure directed to the analysis of every conceivable material, whether solid, liquid, or gaseous. These have resulted in the table of so-called elements, now nearly seventy in number, to which fresh additions are constantly being made. Of this ever-growing list of elements not one has been resolved into simpler bodies for three quarters of a century; and we who are removed by two or three generations from the great builders of our science are tempted to look upon these bodies as though they were really simple forms of matter, not only unresolved, but unresolvable. The notation we employ favours this view and stamps it upon our minds.

Is it, however, a fact that these reputed elements are really simple bodies? Or indeed, are they widely different in the nature of their constitution from those bodies which we know to be chemical compounds? Thus, to take a particular instance, are fluorine, chlorine, bromine, and iodine essentially distinct in their nature from the compounds halogen, cyanogen, sulphocyanogen, ferricyanogen, &c.? Are the metals lithium, sodium, and potassium essentially distinct from such alkaline bases as ammonium, ethylamine, diethylamine, &c.? No philosophical chemist would probably venture to ask this question categorically with either "Yes" or "No."

It was at first hoped that the spectroscope might throw much light upon the nature of elements, and might reveal a common constituent in two or more of them. Thus, for instance, it was conceivable that the spectrum line of bromine or iodine vapour might consist of the rays given by chlorine *plus* some others. All expectations of this have hitherto been disappointed; yet, on the other hand, it must not be supposed that such a result disproves the compound nature of elements, for as investigation proceeds it becomes more and more clear that the spectrum of a compound is not made up of the spectra of its component parts. The general tendency of the arguments is to show that the elementary radicals are essentially different from the compound radicals, though their chemical functions are similar.

There remains still the hypothesis that there is a "primordial element" from which the others are derived by transmutation. With the sages of Asia it was the "blue ether"; with Thales, water; with Dr. Prout, hydrogen. The earlier views have passed away, and the claims of hydrogen are being fought out on the battlefield of atomic weights and their rigorous determination.

There does not appear to be any argument which is fatal to the idea that two or more of our supposed elements may differ from one another rather in form than in substance, or even that the whole 70 are only modifications of a prime element; but chemical analogies seem wanting. The closest analogy would be if we could prepare two allotropic conditions of some body, such as phosphorus or cyanogen, which should carry their allotropism into all their respective compounds, no compound of the one form being capable of change into a compound of the other. Our present knowledge of allotropism and of variations in atomicity affords little, if any, promise of this. The remarkable relations between the atomic weights of the elements, and many peculiarities of their grouping, force upon us the conviction that they are not separate bodies created without reference to one another, but that they have been fashioned or built up from one another according to some general plan. This plan we may hope gradually to understand better; but if we are ever to transform one of these supposed elements into another, or to split up one of them into two or three dissimilar forms of matter, it will probably be by the application of some method of analysis hitherto unknown.

TWO-SPEED TRICYCLES.

By John Browning,

Chairman of the London Tricycle Club.

I TRUST I shall be excused for the delay which has occurred in the appearance of this article, but I have withheld the paper until I could give my experience of each machine to which I have to refer.

The two-speed gearings I shall mention in the order in which I have tested them.

First, then, I must name the Crypto-Dynamic. This elegant contrivance I know less of than any of the rest. I tried it once only on good roads. The gearing for hill riding was equal to 23 in., and there was not a steep hill in the neighbourhood. The hill I tried it on I ran up easily, of course. This was more than a year ago, and I have not been able to hear much about the contrivance since; but it will, I believe, be purchasable by the public next month. It is compact, and easily applied to almost any machine; but I fear it will work with considerable friction if it has to rotate at any great velocity. Should this prove to be the case, it will not be well adapted for tricycles with small wheels.

Next I tested Burdess's two-speed Sterling tricycle. This is the simplest contrivance yet introduced. By pedalling forward you drive the machine, which has 46-in wheels, for speed, and it runs as though it were 56 in. By pedalling backward you drive the machine for power, and it runs as though it were 38 in. The motion can be re-

versed easily, three or four times in a minute, while going. There are no levers to move, nor anything to think of. So soon as driving forward becomes harder work than you like you have only to pedal backwards to gain power.

One great advantage of this arrangement is that in driving the slow-speed gearing to ride up-hill, you bring another set of muscles into play, which, of course, act more vigorously; and, meanwhile, those used for riding over the level roads are being rested. The machine is too highly geared for my own riding. Some strong riders would prefer it so. It is excellent in workmanship, and very strongly made. It would be improved if the wheels were smaller and the weight reduced by 10 or 20 lb.; but, even as it is, after trying it for weeks over all conditions of roads, and in all kinds of wind and weather, I can say that I have not been able to get it out of order, and that it runs easily and well.

Lloyd Brothers' two-speed Quadrant Tricycle was the next machine I tested. This is a very ingenious contrivance. The gearing-down of the machine for hill-riding is effected by pressing a lever. This causes the upper chain-wheel to *expand*, and so carry the driving-wheels round slower than the cranks are turning. The machine is a double-driver and front-steerer, central-geared. I tried it up steep hills, over roads rotten with rain, and against a strong wind, and none of these unfavourable conditions stopped me. The machine I tried was the first experimental machine, and so was unnecessarily heavy, but as the makers have produced the lightest "Sociable" yet made, I suppose that future machines of this kind will be proportionably light.

Thanks to the kindness of Mr. Grace, I next tried the "Diana." This machine has two pairs of chain wheels, and two chains. Either of these can be thrown in or out of gear, and the other one allowed to run freely. One chain drives for speed and the other for power. When the high speed is on the wheels are level-geared—that is, 40-in. wheels run as 40 in., 50 in. as 50 in., &c.; in other words, the greatest speed depends on the size of your driving wheels. Pulling back a small lever gears the machine down for hill riding. In an intermediate position of the lever, both chains are out of gear and run free. On long, slight downward inclines this is advantageous.

The machine tried was built specially for Mr. Grace, who kindly consulted me before he had it put in hand.

The wheels are 46 inches, because that was the smallest size the makers could supply.

This, as I have explained, determined the high speed for the level. When geared down the machine ran as 32 inches. I have ridden it on several occasions, once for half-a-day over muddy roads, up-hill, nearly all the way against a wind so high that I had to drive hard even down a long steep hill at the end of my trial. The machine is a great success, but it could be made 20 lb. lighter with great advantage. Making the wheels 40 in., and gearing them up to 48 in. or 50 in. for high speed would facilitate this reduction of weight.

As a proof of the power of the machine, I may say that I have seen Mr. Grace ride it up the steep rough hill which leads from Redhill to Bletchingley—the road at the time being covered with mud which buried the tires and rims, and in this mud there was a quantity of loose stones. This hill is a severe task for a first-rate rider in fine weather when the road surface is in the best condition. Mr. Grace will, I am sure, agree with me that if the "Diana" were made with 40-in. wheels, and were geared so that the speed-gearing ran as fifty inches and the power-gearing as thirty inches, and the weight were reduced about 20 lb., as it might easily be, we should then have a model two-speed machine.

The last two-speed machine I have tried is Grout's "Adroit" tricycle.

This is a lever machine in which the fulcrum of the levers can be changed by turning the holding handle on the left-hand side—that is, on the opposite side to the steering handle. There is so wide a range of adjustment that the machine may be altered while running to equal any gearing from 20 in. to 60 in., and stopped at any point between at pleasure. It is a front steerer and double driver, and the band brake will stop it dead. The machine is light, and the maker will construct it with wheels of any diameter from 40 in. to 50 in. I tried it on rough wet roads and it performed well. With those who do not object to a lever machine I should think the "Adroit" multi-speed tricycle will be a favourite next season.

On a single tricycle the two-speed gearing will be valuable in many ways.

A beginner who commences with a two-speed machine may ride with the power-gearing until his muscles become accustomed to the unusual action, and put on the speed-gearing as he acquires strength in riding.

A man who uses a tricycle for the purpose of carrying a heavy weight will ride with the power-gearing while he is carrying the weight, and with the speed-gearing as soon as he is relieved from it.

Thus, a rider who carries a set of photographic apparatus of the largest size, to take pictures 12 in. by 10 in., which will weigh from 30 lb. to 40 lb., will use his power-gearing only, and will ride with the same ease with a reduction in his speed.

A "Sociable" with a two-speed gearing, when used by a gentleman with an unpractised or weak lady rider, would, as a rule, be ridden geared-down, that is, with the power-gearing; but when ridden by another gentleman as strong or stronger than himself, the same machine would be ridden geared-up, that is, with the speed-gearing, and a much higher speed attained without undue exertion.

Dr. Richardson, in his admirably-suggestive essay, just published in *Longman's Magazine*, has protested against cycling being treated simply as a sport, and has pointed out in weighty words the evils that must ensue from pursuing such a course.

I look forward to the adoption of the "Sociable" tricycle as the most likely means of elevating tricycling as a healthful pastime and an intellectual recreation. The successful application of changeable speed-gearing is a new era in cycling.

Burnham Beeches.—Mr. F. G. Heath is issuing, through Messrs. Rider & Son, at the office of *Forestry*, a shilling edition (illustrated) of his little work "Burnham Beeches." It will appear opportunely in connection with the public dedication of Burnham Beeches, next week, by the Corporation of London.

Evaporation and Electricity.—Dr. L. J. Blake has been investigating the statements of Pouillet and others to the effect that electricity is produced by the simple evaporation of a liquid. He worked with sea-water, sulphate of copper solution, chloride of sodium solution, &c., but in every case the results went to show that electricity is not produced in this way, and that some other means must be found of explaining the production of atmospheric electricity. Dr. Blake also negatives the hypothesis of Franklin and others to the effect that electricity is conveyed by still evaporation from an electrified liquid. The experiments were conducted with a quadrant electrometer of M. Voss, Berlin.—*Engineering*.

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SEA ANEMONES

AT THE FISHERIES EXHIBITION.

By Thomas Kimber.

V.—THE DAISY.

(*Continued from page* 188.)

"Hail, holy light, offspring of Heaven first-born."—*Milton.*

BEND and distort any plant as we may, the strongest proof that it is wrested from its original and inherent nature will be in the ceaseless efforts which it evinces to raise its struggling branches to the skies. In like manner sea anemones follow this law of vegetable life, though feeble, indeed, must be the ray in those sea-depths where some of the largest and brightest species flourish and bloom.

Darken the top of the aquarium, and Daisy bends her stem that the disk may face the lighter side of her home, and though some actiniæ are impatient of a strong light, it would seem that utter and continued darkness are incompatible with full health in any species, and the free expansion of their flower.

The daisy—as before pointed out—differs from all other anemones in having comparatively a very slender column, whose average diameter is not more than one-fourth that of the disk; she is prolific, and in many cases both viviparous and oviparous. The fully-formed young are discharged from the *gonidal grooves*, whence the ova also make their appearance. The shape and marking of the newly-born daisy are readily recognised, the chief distinction between the young and their parent being, apart from size, the small number of tentacles—not more than a baker's dozen—and these are larger in proportion in the young than in the adult.

It has been frequently noticed in anemones generally that a large animal has large offspring, the reason being, it is very naturally concluded, that a large body allows more space for the fuller development of the young before they are brought into the world than it is possible in the case of a small parent that is equally productive. The mature ova, however, are observed to be of the same size in the same species.

Bellis is sometimes obtained from deep water, but its favourite resorts are pools, crannies, rock fissures, and other similar hiding-places between tidal limits. In many such cases daisy is difficult to get at, for when the disk can be seen and reached, the base is found to be fixed in some crevice which the animal has chosen for safety. A hammer, steel chisel, and great patience are then necessary, as without these three requisites there is a strong probability that in tearing away the animal the central portion of the base will be left behind. The creature so mutilated will afterwards occasionally expand its bloom and look healthy for a time, but seldom survives its proper period. Cases, however, are met with in many species in which immoderate wounds and lacerations heal, and lost parts are restored. The safest way, and the most satisfactory to both parties—daisy and her captor—is to cut off a piece of the conglomerate to which she is usually attached.

Still colonies are not unfrequently met with in situations more favourable to the collector, as in superficial fissures, and shallow hollows of coarse sand, or puddingstone, where, at ebb tide, only a few inches of water cover them. In these situations they are frequently so crowded that their disks pressing upon each other lose their circular shape. The flower is puckered and frilled, filling all the interstices, and presenting a continuous surface of distorted disks. The amount of bright colour thus displayed is inconsiderable, but the effect upon close inspection of the convoluted and fringe-like pattern is pleasing for its novelty. Mr. Gosse mentions a variety of this species ("Actinologia," p. 33), at Weymouth, which he names *Sordida*. These anemones are met with on fetid mud, and are dingy in appearance. Their bases simply rest on the slime, but when removed to a vessel of clear sea-water, they very soon become attached to the bottom or side. They differ widely from the Cornish mud-dwelling variety described on page 188.

The Daisy is a hungry creature, and will eat varaciously bits of meat, fish, oysters, worms, or almost any animal substance. For the most part *bellis* is stationary, and when in sound health is nearly always open. She is essentially a southern beauty, more of a French than an English *belle*, somewhat Irish, and very little Scotch.

Daisy has been found on the south-west shores of Scotland, in Rathlin Island, Dublin Bay, and the south and west coasts of England and Ireland. She is constantly being captured at Boulogne and in the Channel Islands; she is also found by myriads near Oporto. The older writers, Lamark and Blainville, give the shores of the Mediterranean as her chief *habitat*, but pre-eminently the Bay of Naples.

In Dana's great American work there are three brilliant anemones named and described, which have some of the leading traits and habits of Bellis—*Actinia decorata* from a Lagoon of Honden Island, *A. Fuegiensis*, and *A. Impatiens* from crevices of rocks and tide-pools in Orange Harbour, Terra del Fuego.

The examples of daisy in the Fisheries are not numerous, and are scattered in various small vases and tanks, but amongst them are a few very good specimens. By the way, all the tanks now (Sept. 21), are in excellent condition, the water in them is bright, and the greater part of, if not all, their denizens appear in vigorous health and are seen to great advantage. Only a week or two ago this was not the case, and just criticisms were beginning to make their appearance in the daily press. The improvement, however, has been prompt and so far very complete and effectual.

This department continues to be one of the most attractive in the Exhibition—more particularly when illuminated in the evening, and all the tanks, in consequence, are then excessively interviewed, without regard for the comfort or welfare of their occupants. Frequent renewals of the less hardy are therefore indispensable under the present pressure of visitors.

Where practicable, the anemone and other tanks should be looked at during the early part of the day, as by the electric light anything like a careful and quiet examination of them is impossible.

Electric Lighting in Mills.—A mill situate on the banks of the Doria, near Turin, is lighted by means of sixty-four Swan lamps. The current is supplied by a Gramme dynamo, driven by the water-wheels of the mill. The speed of the dynamo does not exceed eight hundred revolutions per minute. The installation is reported to give great satisfaction. The Swan lamps have replaced colza oil.—*Electrician.*

Edison System in the House.—Mr. Shaw Lefevre has purchased the Edison plant which has been in use at the House of Commons during the past Session. He intends, owing to the success attending the existing installation, to adopt the light as a permanency, and to considerably extend its use. The existing plant consists of 250-light dynamos, and 276 lamps, with all necessary fittings. The new plant will comprise an Armington and Sim's high-speed engine, and two L (250-light) dynamos. The total number of fresh lamps to be employed will be 214.

TRUTH AND POKER.

By Richard A. Proctor.

An angry man is apt to appear unfavourably in a fencing bout. He aims wildly at a seemingly exposed but really well-guarded spot, leaving himself open to a *riposte* which, but for his wild attack, might easily have been foiled. I fear Mr. Labouchere must be angry with me, he has twice attacked me so thoughtlessly. (Yet have I given him no just cause for anger.) *Truth* need not have a bad memory, though untruth we are told should have a good one. One week it rushes out with upraised cudgel, to fell me to earth by calling my article on Poker in *Longman's Magazine* a silly paper which proves too lengthily that two and two make four, yet (strangely) quoting as "curious" my enumeration of poker hands: next week another way of hitting at Proctor's Poker is tried (any stroke seems right to the blindly angry).

"A correspondent writes" (says Mr. Labouchere) "to point out the inaccuracy of Mr. Proctor's 'Poker Figures,' which I cited last week. 'There can,' he says, 'be only 78 possible pairs in an ordinary pack of cards, and not 1,098,240, if any two cards of the same denomination constitute "a pair." So, too, in regard to "triplets;" he thinks there can be 54,912; I contend there can only be 52. Again: he makes "fours" produce 624, whilst I can only make them produce 13. It appears to me that your authority (whom you did not appear to deem much of an authority) considers any two cards to be "a pair," instead of two cards of the same denomination.' I merely quoted the calculations from an article on Poker, by Mr. Proctor, in *Longman's Magazine, quantum valeant.*"

Yes; but, my good sir, you should have a better memory: you accompanied your quotation with the remark that my article proved only that "two and two make four, with other such matters of universal cognition." (I quote from memory, but I can trust *my* memory.) It would seem that now you are in doubt whether two and two make four, and not (perhaps) five, or (it may be) three. After showing your familiarity with whist by confounding "finessing" with "underplay," you further illustrate your "universal cognition" by inserting preposterous comments as possibly valid criticism,—but possibly not, you cannot for the life of you say which. Permit me to remark (I will not say "explain," lest you should remind me then of your "universal cognition") that though there are only 78 possible "pairs" in an ordinary pack of cards, there are 1,098,240 "pair hands" at poker; though there are only fifty-two possible "threes," yet there are 54,912 "triplet hands"; though there are but thirteen "fours," yet are there (as I have said and shown) 624 "four hands;" and lastly if (becoming temporarily idiotic) I had supposed *any* two cards to be a "pair," I should still not have arrived at the number 1,098,240, the total number of two-card combinations in a pack being only 1,326.

[These and similar relations in card games I may shortly discuss in these columns—at the risk, even, of being told (by, but not with, *Truth*) that I am dealing with matters of universal cognition.]

EVOLUTION OF CONDUCT.

What says the doctrine of evolution with regard to the ethical side of this twofold assertion that lies at the bottom of all religion? Though we cannot fathom the nature of the inscrutable Power that animates the world, we know, nevertheless, a great many things that it does. Does this eternal Power, then, work for righteousness? Is there a divine sanction for holiness and a divine condemnation for sin? Are the principles of right living really connected with the intimate constitution of the universe? If the answer of science to these questions be affirmative, then the agreement with religion is complete, both on the speculative and on the practical sides; and that phantom which has been the abiding terror of timid and superficial minds—that phantom of the hostility between religion and science—is exorcised now and for ever. Now, science began to return a decisively affirmative answer to such questions as these, when it began, with Mr. Spencer, to explain moral beliefs and moral sentiments as products of evolution. For clearly, when you say of a moral belief or a moral sentiment that it is a product of evolution you imply that it is something which the universe through untold ages has been labouring to bring forth, and you ascribe to it a value proportionate to the enormous effort that it has cost to produce it. Still more, when with Mr. Spencer we study the principles of right living as part and parcel of the whole doctrine of the development of life upon the earth; when we see that, in an ultimate analysis, that is right which tends to enhance fulness of life, and that is wrong which tends to detract from fulness of life,—we then see that the distinction between right and wrong is rooted in the deepest foundations of the universe; we see that the very same forces, subtle and exquisite and profound, which brought upon the scene the primal germs of life and caused them to unfold, which through countless ages of struggle and death have cherished the life that could live more perfectly and destroyed the life that could only live less perfectly, until humanity, with all its hopes and fears and aspirations, has come into being as the crown of all this stupendous work—we see that these very same subtle and exquisite forces have wrought into the very fibres of the universe those principles of right living which it is man's highest function to put into practice. The theoretical sanction thus given to right living is incomparably the most powerful that has ever been assigned in any philosophy of ethics. Human responsibility is made more strict and solemn than ever, when the eternal Power that lives in every event of the universe is thus seen to be in the deepest possible sense the author of the moral law that should guide our lives, and in obedience to which lies our only guarantee of the happiness which is incorruptible—which neither inevitable misfortune nor unmerited obloquy can ever take away.—John Fiske.

RELIEF OF SEA-SICKNESS.

In spite of the fact that much has been written on the subject, people still continue to suffer from sea-sickness, which proves the unreliability of our therapeutic resources. Therefore the following experience of Dr. T. M. Kendall, who has recently had 200 cases under his charge, may prove interesting:—

Many people, as soon as sea-sickness commences, have recourse to oranges, lemons, &c. Now oranges are very much to be avoided, on account of their bilious tendency, and even the juice of a lemon should only be allowed in cases of extreme nausea.

Champagne, too, is a very common remedy, and, without doubt, in many cases does good; but this appears to be chiefly due to its exhilarating effects, as if it be discontinued, the result is bad, and a great amount of prostration follows.

Creosote is a very old but still very good remedy, and, in cases accompanied by great prostration, is very useful;

XUM

but if given in the early stages of sea-sickness, it is often followed by very bad results, and even increases the nausea.

Bicarbonate of soda is useful in slight cases, as it relieves nausea, and checks the frequent eructations which often follow attacks of sea-sickness; but in severe cases it is absolutely useless, and, in fact, it very often prolongs the retching.

A very good remedy in the earlier stages of sea-sickness is a teaspoonful of *Worcester Sauce*. How this acts I cannot say; but it without doubt relieves the symptoms and renders the patient easier. Its action is probably of a stimulant nature.

Hydrocyanic acid is of very little service, and most acid mixtures are to be avoided, except that, perhaps, for drinking purposes, when it is best to acidulate the water with a small quantity of hydrochloric acid.

Of all the drugs used, I found the most effectual was *bromide of sodium*. When bromide of sodium is given in doses of ten grains three times a day, the attacks entirely subside, the appetite improves, and the patient is able to walk about with comfort.

In all cases of sea-sickness, it is very desirable that the patient should take sufficient food, so that at all times the stomach may be comfortably full, for by this means overstraining during fits of retching is prevented, and the amount of nausea diminished. The practice of taking small pieces of dry biscuit is not of much use; as, although the biscuit is retained by the stomach, yet the amount taken is never sufficient to comfortably fill the stomach. Soups, milk puddings, and sweets are to be avoided, as they increase the desire to be sick and are followed by sickening eructations. Fat bacon is easily borne, and does much good, if only the patient can conquer his aversion to it. When taken in moderate quantity, it acts like a charm, and is followed by very good results.

But of all food, *curry* is the most useful in sea sickness, and is retained by the stomach when all other food has been rejected. Next to curry, I would place small sandwiches of cold beef, as they look nice on the plate, and are usually retained by the stomach.

In conclusion, I would advise that brandy should be used very sparingly, as in many cases it induces sea sickness; and its chief use is confined to those cases where the prostration is very great, and even then champagne is more effectual.—*Scientific American.*

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

GOETHE anticipated the mode of studying nature now generally admitted to be right, when he said to Eckermann, "The utility teachers say that oxen have horns to defend themselves, but I ask, why is the sheep without any? If, on the other hand, I say the ox defends himself with his horns because he has them, it is quite a different matter." Some shallow thinkers have regarded this mode of reasoning as opposed to a recognition of design in nature, but it is not so. Sciences of observation and experiment have to do only with how and what. The *why* remains for philosophical consideration, and as the old design argument fades away on account of its narrowness and insufficency a much grander one arises, showing that the adaptation of organisms to their surroundings arises out of general laws, and cannot be rightly viewed as so many disconnected exhibitions of creative skill. Let us examine two insects belonging to the great Order Hymenoptera, and notice how importantly their mouth organs help to determine their way of living. If the head of a wasp is looked at with a hand magnifier, immediately below its upper lip two remarkably powerful mandibles are seen. They work—as insects' jaws generally do—horizontally, and are furnished with strong, pointed teeth. Look in the same way at a honey bee. Its mandibles are much smaller, its face looks more innocent; quite mild as compared with the tiger-like countenance of the wasp. Its jaws inform us at once by their aspect that the creature will not be engaged, as the wasp will, in hard biting work. Extending a little beyond the mandibles, the pocket lens will show, in the wasp, a short, squarish, three-cleft organ of gauzy texture, the centre portion being the biggest, with a yellow spot at each tip, and similar spots, one each at the tips of the side divisions. This is a lapping tongue. The bee's tongue is also a lapping one, but constitutes a much larger and more powerful-feeding machine. It lies between two labial palpi and two maxillæ, which all join to form a tubular sort of sheath for it.

A good way to know something of this remarkable apparatus is to catch a bee in a bottle, and see it feed. For this purpose a wide-mouthed bottle, of thin glass and about one inch in diameter, will do; or, still better, a wide-mouthed test-tube, which can be bought for one penny, and which should be fitted with a cork not tight enough to exclude fresh air. The bee is easily caged while busied with a flower. Let it have a little time to recover from its astonishment and alarm, and then, while it is in the bottom of the tube, withdraw the cork, and put a little syrup of sugar and water upon it before replacing it. Previous to commencing dinner, the bee's tongue and adjacent mouth-organs look like a brown flattened tube of gutta-percha, curved—if one may so speak—under its chin, and towards its breast. As soon as it finds the syrup, the jaws open, the tongue is thrust forward between them, and an unexpected piece is shot out beyond the maxillæ. The pocket lens will indicate that this portion is very hairy, especially towards its tip. It may, in fact, be likened to a long-haired flexible broom, and the insect uses it accordingly. The long hairs all point downwards, so that, when the creature bends the end of the tongue backwards, lays it along the cork, and then draws it forwards, it acts exactly as we should do if we were using a flexible brush to wipe up a slop. Every now and then the creature draws the tongue between its hairy fore-legs, as if to clean it, but the action may also bring the fluid down to an orifice through which, I think, it is sucked up. Another curious motion may also be seen, that of thrusting the tip of the tongue backwards towards its body. Is this only another cleaning process? or does the bee propose to carry off some of the syrup sticking to its hairs? Let the reader catch some bees, feed them well, and pay attention to their ways.

In a former number will be found figures of the mouth organs of the biting breeze flies. Their maxillæ are carving-knives, very unpleasant when used upon ourselves. The bees' maxillæ serve quite another purpose; they are not cutting implements at all, but combine with the next inner organs, the hairy labial palpi, to cover the tongue, and stroke down the fluid it laps up, when the insect rapidly withdraws the extended part up into the tube-like sheath which they form. This is the interpretation of their use which watching the feeding process suggests.

It is evident that the wasp's very different tongue could not do such effective lapping, and its shortness would prevent its gathering the nectar of many tubular flowers, as

the bee can do. But the wasp can bring his jaws to aid; and a little while ago, when Redhot Pokers (*Tritomauvaria*) were in bloom, numbers of wasps might be seen biting holes round the bottom of the tubular flowers, and thus enabling their short tongues to get at the coveted nectar.

It may be incidentally mentioned that the Redhot Poker was introduced from Africa no great while ago, and English wasps must have contemplated it as a strange plant, which neither they nor their grandfathers had ever fed upon. The first wasp who tapped its corolla must have been an adventurous experimenter—in his way a reasoner from analogy, and a benefactor to his race.

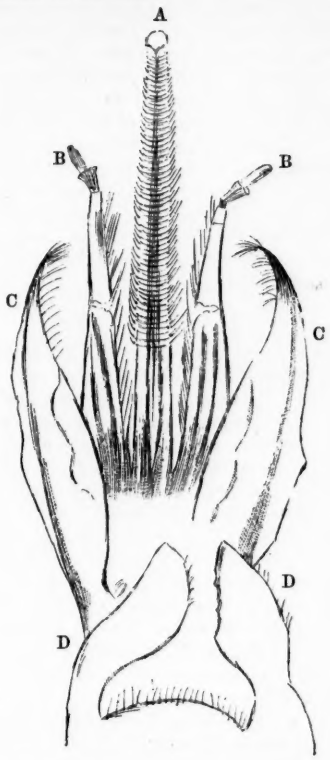


Fig. 1.—Mouth-organs of Honey Bee. A. Tongue extended. BB. Labial palpi. CC. Maxillæ. DD. Mandibles, depressed to show other organs more plainly. When the bee sucks the tongue, &c., are raised and protruded between them. (Drawn from the objects uncompressed by Mrs. Slack.) × 20.

We shall proceed in another paper to a minute examination of the bee's mouth organs, but will now further consider what more the examination with a pocket lens suggests.

Having regard to the size of the two insects, and to the small quantity of food required for a creature that completes its growth at the time of its emergence from its pupa state, the bee's mouth organs suggest that it might gather much more food than its own needs require, while the wasp's mouth organs suggest that a more varied food and a smaller quantity may suit its habits. This is the case. The bee has not only to feed a host of young during the warm months, but to lay up a store of food for a large population to live upon at waking times during the winter. The wasp has also to feed its young, but when the cold weather comes the bulk of the colony dies, leaving only some females to lay eggs and found a fresh city of paper houses when spring returns. The bee, making its comb and cells of wax, needs to eat the right food for this substance to be secreted. The wasp, to create its paper, has to bite wood and other substances which its big strong jaws make easy work, but which the bee's jaws are not fit for. A bee could make no impression upon a firm apple, but a wasp soon gnaws a great hole in one, chiefly to suck its juices, as its small waist would forbid the passage of solid particles, unless of very minute dimensions.

Fig. 2.—Wasp's tongue and labial palpi. (Copied from Westwood.) × 10.

The mandibles, or jaws, of the bee come into special use in forming the comb. The wax is secreted in thin plates between the segments of the abdomen. This substance is kneaded by the mandibles, and added layer by layer to form the comb. In its early stage this consists of shapeless blocks, which the mandibles mould into shape. The mandibles serve a great number of other purposes. They are the insects hands as well as cutting tools. The subject will be continued in the next paper.

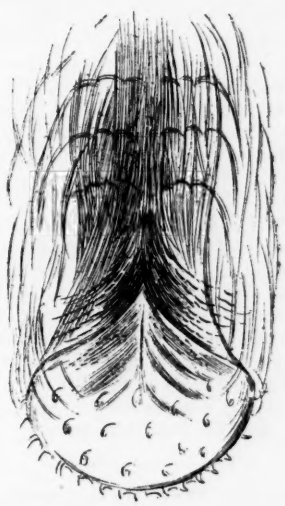


Fig. 3.—Tip of Bee's tongue, underside uppermost. (Drawn from preparation in Canada balsam by Mrs. Slack.) × 600.

Editorial Gossip.

A GREAT deal has been said about newspaper science, which is often spoken of as if it were uniformly valueless. That this view cannot be altogether correct is shown by the circumstance that many of our most distinguished men of science have written newspaper articles on their own special subjects, and that such articles have not unfrequently been embodied subsequently in scientific works of high standing. I am myself somewhat unwilling to see newspaper science systematically abused and ridiculed. For I have written many hundreds of newspaper articles—not all, by the way, on subjects which belong to my own special lines of research. I have always strictly limited

what I have said to what I knew and understood, not thereby always escaping error (for this none can do) but escaping the blunders which necessarily arise when the blind undertake to lead the blind. This rule, carefully and honestly followed, should be all that is necessary to keep newspaper science above reproach.

But unfortunately many who write for our daily and weekly papers are not troubled with much fear of bringing reproach upon newspaper science or on the particular newspapers to which they are good enough to contribute. The editor of a newspaper cannot be familiar with every department of science, if even with any. He cannot always be able even to distinguish those who are competent to write on any subject from those who are not. If a man known to have done good work in one department of a particular science offers to write on any matter connected with the subject, and possesses a tolerably effective literary style, an editor can hardly be blamed if he accepts and inserts the proffered contribution, even though it should turn out to be in reality utterly valueless and full of egregious blunders. The dishonesty of the writer is the real trouble, not the editor's want of scientific knowledge—a kind of knowledge not to be expected in a man who has to give his attention to other and very different matters.

These remarks have been suggested by the reading of a leading article in the *Times* of Saturday, September 22, on the subject of Dr. Ball's excellent discourse on the Sun's Distance now appearing in these pages. Who may be the author of the article, I have no means of knowing. That it has appeared in such a paper as the *Times* is sufficient evidence that the writer has done some good work, or has the general credit of having done such work, in astronomy; for otherwise the article would never have been accepted. But that the writer is hopelessly ignorant of the elementary mathematics of astronomy is equally obvious. It becomes very difficult, therefore, to explain how, without dishonesty, this article came to be written for the *Times*. If there is a less unpleasant explanation, let us hope that before long it will be given; for, while the occurrence of occasional errors or even blunders in newspaper science may cause no great harm in the long run, the display of deliberate dishonesty such as has in this case, I fear, been shown, would be a serious misfortune.

It is not to correct the errors in the article in question that I point them out, but because they are part of the evidence of what appears to me deplorable want of principle in some writer unknown. Here is an article on astronomy in a tone implying right to speak "as having authority." The writer talks condescendingly about "the mind of the average man," about "non-scientific persons," and so forth, and about the enlarged conceptions which such folk should form of "the laborious and patient accuracy of scientific work." But while, in the whole article, there is no trace of original thought or of any real grasp of what Dr. Ball himself had clearly explained in his lecture, there are blunders such as none but a charlatan writing of what he knew nothing about could possibly have made. We are told that Neptune was "looked for in the position from which its disturbance was exercised," which is preposterous; that the "larger of the asteroids, under favourable conditions, come within" such and such distances of the earth, as if size had anything to do with the matter; and that Dr. Ball saw Venus (at Dunsink) in the middle of her transit last December, the middle of the transit occurring long after the sun had set at Dr. Ball's station. But these are only blunders, showing indeed the ignorance and inaccuracy of the writer, and otherwise insignificant. What, however, is to be said or thought of the deliberate statement that, "in consequence of the motion of the earth round an elliptical orbit, the distance which separates us from the sun is variable, being greatest when our planet is on the major axis, smallest when it is on the minor axis of the ellipse"? If the statement had been less precise in its nature, we might have supposed that the error had arisen from mere carelessness; but in the sentence as it stands the writer deliberately expresses and even emphasises his ignorance. Nobody who knew, as every one familiar with the elements of astronomy must know, that the earth is nearest to the sun when passing one extremity of the major axis of her orbit, farthest from him when passing the other, and at his mean distance when on the minor axis, could possibly have made such a statement as we have quoted. One would only too willingly ascribe it to mere carelessness on the part of one who really knew better; for by so doing the evidence of dishonesty might be overlooked. But unfortunately no such interpretation seems possible.

Completion of Second Million Issues at Mitchell Library, Glasgow.—This library has now completed the second million in the number of volumes issued to readers, and advantage may be taken of this circumstance to draw attention to the very remarkable degree in which Mr. Mitchell's benefaction has been appreciated and made use of by all classes of the citizens—artisans, clerks, students, and professional men. The first book, "Liber Officialis Sancti Andree" (Abbotsford Club), was issued at ten o'clock in the morning of Nov. 5, 1877; the first million issues were completed Jan. 14, 1881, being 982 working days from the opening; the second million issues were completed at 6.45 p.m. on Saturday last, Sept. 1, 1883, and occupied 808 working days. It is believed that there is no previous instance on record of the issue of two million volumes within so short a period of the opening of a public library. As will be seen from the statistics below, the reading of fiction forms but a small proportion. It should be stated, too, that in addition to this large number of volumes asked for at the counter there has been a very great use made of the current periodicals—literary, artistic, scientific, technical, professional, and other—which, to the number of more than 200, lie openly upon the tables. The following is a statement of the number of volumes issued in each of the classes in which the library is arranged, with relative proportion of the whole issue:—

		Per Cent.
Theology and philosophy	184,681	(9·23)
History, biography, &c.....	435,326	(21·77)
Law, politics, and commerce ...	54,694	(2·73)
Arts and sciences	402,485	(20·12)
Poetry and the drama	147,115	(7·36)
Language.....	54,971	(2·75)
Prose fiction	145,605	(7·73)
Miscellaneous literature	566,123	(28·31)
Total.....	2,000,000	(100·00)

Of the whole issue, no more than 10,481 volumes have been issued to ladies, or only 5 per cent. This small attendance of ladies is regretted, but is probably due to the absence of separate accommodation of a suitable character.

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

SIR WILLIAM HERSCHEL.

[947]—I shall feel obliged if your contributor "A Fellow of the Royal Astronomical Society"—the one, I mean, who wrote "The Sun in a Three-inch Telescope"—will communicate his authority for the statement that "Sir William Hershel lost an eye" in an attempt to look at the sun without suitable protection. It may be true; but to the best of my recollection I never heard of it before.

Collingwood, Sept. 28, 1883. J. Herschel.

ASTRONOMY OF THE *TIMES*.

[948]—The *Times* of September 22nd, in its leader on Professor Ball's address to the British Association, informs us, in reference to the Earth's Orbit, that "the distance that separates us from the sun is variable, being greatest when our planet is on the major axis, smallest when it is on the minor axis of the ellipse," so that, putting a for the semi-major axis of the earth's orbit, and e for the eccentricity (when, of course, $e<1$) we must infer from the *Times* that

$$a\,(1-e) > a\sqrt{1-e^2},$$

and therefore, that

$$\sqrt{1-e} > \sqrt{1+e}.$$

which is, &c. J. R. C.

CURIOUS PHENOMENON.

[949]—In your number of September 14 last, page 173, is an account of a curious phenomenon, which is illustrated by an engraving.

This evening, Sept. 21, at 8.30 p.m., I observed just such a phenomenon also in the E.N.E., about 20° above the horizon.

The sky was cloudy at the time, and in the very words of the article mentioned, "For a moment I imagined that I was viewing the apparition of a new and glorious comet," the light was too white to have an artificial terrestrial origin; it remained well in view for five minutes, but before I could bring a telescope to bear upon it, it slowly faded. Mrs. Harbin.

Preston House, Yeovil.

THE "SUN AND PLANET" BICYCLE.

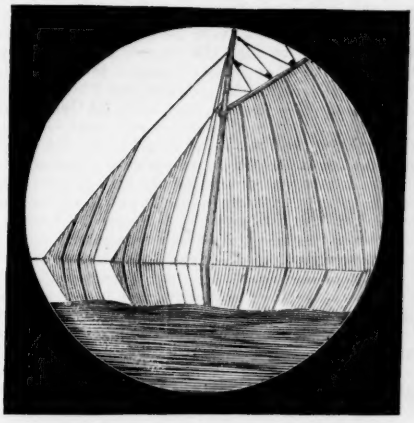
[950]—There are two misprints in my letter (942). In line 9, the word "seat" should be "feet"; and about "Sigma," I said that he seemed to have *no* idea that Mr. Browning spoke of *geared-up* wheels.

As to appearance, I should think a man looked better on a small, neat machine than inside such a squirrel-cage as a 60-inch "Otto."

S. J.

HULL-DOWN SHIP.

[951]—Your interesting articles called "Pretty Proofs of the Earth's Rotundity" have caused me to take a new interest in the visible sea-horizon, and I have been observing it while on the south coast recently with a 3½-inch telescope, of the kind recommended in Knowledge. But a phenomenon I do not understand at all has presented itself: to a ship, hull-down there have seemed to be two horizons, a nearer one clear and distinct, on which the rise and fall of the waves could be seen, and a farther



one which really concealed the ship and gave it the appearance of floating in the air; and still more oddly a kind of reflection of the ship's sails connected the more distant with the nearer horizon, something as in this sketch, which I hope you can make out. Is this usual? Would you kindly explain it for the benefit of myself and a few friends who saw but could not understand it, and you will greatly oblige H.A.L.S.

[Doubtless there was a layer of still air above the distant water surface, of density greater than that of layer of air next above it; and the ship was reflected in that as in a horizontal mirror. R. P.]

TOTEMISM.

[952]—Mr. Edward Clodd, in the fifteenth chapter of his interesting series of articles on "The Birth and Growth of Myth," touches on the customs and prohibitions which *totemism* has imposed upon savage and barbaric peoples; he quotes as instances the American-Indians and Australian tribes. He also speaks of a form of salutation common to a certain province in China, but he has omitted to notice a singular custom of the same type which prevails in the native States of Cochin and Travancore in the Southern part of the Indian peninsula.

These States cannot be styled savage or barbaric. One-third of the whole native population is Christian; of the native castes, the so-called Namburi Brahmins rank first; after them come the Nairs. It is of these we would speak. The rulers of these States are themselves of Nair descent. When they succeed to the throne they are *made* Brahmins. They are "new-born" by passing through a golden cow, or vessel of that metal, which then becomes the property of the Brahmin priests.

The females of the Royal families in these States invariably marry Brahmins, but all Nair women have the privilege of choosing their own husbands; by law they may change them as often as they will, but this, it is said, is going out of fashion.

Obviously, this custom led to great confusion in the matter of inheritance; therefore amongst the Nair caste a man's heirs are not his own children—his property descends to the children of his sisters or of his female cousins, however remote.

With regard to polyandry, we think it will generally be found to exist in mountainous districts, and where the soil is very poor and can only support a very small population. Such, at least, are the conditions in Ladakh, or Western Thibet, where this custom prevails. Certain Europeans, who closely watched them for some years with that object, could never discover that its inhabitants practised infanticide. Cosmopolitan.

LETTERS RECEIVED AND SHORT ANSWERS.

E. D. Girdlestone.—*Imprimis*, let me remark that I only object to the waste of time over the study of formal logic, especially by those who are capable of reasoning correctly. I would not in the slightest degree object to your studying logic. And now to your illogical defence of Jack Ketch. You argue correctly enough about a suppositious Jack Ketch, who never existed save in your imagination. If the legislature had to select an executioner from among

a number of citizens, all unwilling to take the office, but ready to do so as a duty when actually called to the work, no one would think of calling the executioner a murderous ruffian. I apply that term to each one of those who have been in the past, are now, or will hereafter be (so long as our present system continues) eager candidates for an office which none but a murderous ruffian would accept, if he could avoid it without failing in duty to his countrymen. If you can believe that the numerous applicants who have come forward for the office within the past few weeks have done so with a feeling of repugnance against taking life, but a feeling also that it was their clear duty to offer themselves for the work, a painful duty which they could not conscientiously avoid,—why then, you can believe anything, and reasoning would be thrown away on you. Every one knows that the actual case is very different, that every one of the applicants (every man Jack or Jack Ketch of them) has deliberately sought to adopt man-killing as the business or part of the business of his life. It is well, in the horror which the presence of so many brutally-minded wretches amongst us must excite in every rightly-constituted mind, to find that some of the "hangman knaves" are ashamed to let their names be known, *until sure of the office*. To compare soldiers with hangmen is sheer nonsense. A soldier is primarily a man who takes as his office a part in the work of defending his country at the risk of his own life and limbs. His country may engage in wicked wars, and the necessities of the service, the rules of its discipline, and so forth, may make him one of the number of those employed in wars of that particular kind. During the course of such wars his hand may take away the lives of other men. But no soldier ever gets enlisted with the thought that it would be a pleasant thing to him to take away life; whereas there never yet was an applicant for the office of common hangman who was without this hideous incentive. It would not be a bad thing for the future of this country if every man who had publicly announced his readiness to take away life, his eager hankering for the hangman's office, were removed, along with his children and his nearest kinsfolk, to a place where they could be kept apart from their fellow men till the lot had in due course of nature died out. I say it would not be a bad thing for the country, not that it would be just, especially to the kinsfolk; for in many cases these murderous folk are sports of nature, their kinsfolk being often gently-minded, worthy people. But it is terrible to think of these slaughter-loving men marrying and multiplying their kind in our midst.—J. Terry Patch. I think no such statement of the plan and purpose of Knowledge at all necessary, after what has been so clearly said (and so often) already. It seems to me unreasonable to insinuate that Mr. Clodd intended "a sneer at the faith of Christians" in speaking of the injunction to the Hebrews against eating pork as not actually a revelation of God's will. (You misunderstand Mr. Clodd's use of "pseudo" in combination with the word revelation; he does not mean either a false revelation or the statement of something false as if it were a revelation, but simply that a certain statement has mistakenly been regarded as a revelation.) You might as reasonably accuse your neighbour at breakfast or dinner of intending a covert insinuation against the faith of Christendom when he takes ham with his eggs or bacon with his chicken! Read what the reverend head-master of Clifton has said about inspiration, and you will find abundant evidence that the ablest and most learned theologians reject the idea of inspiration of the kind you imagine, while the fiercest enemies of the faith you fancy you are defending find in the doctrine of *such* inspiration the readiest and most effective weapon of attack. No wonder with such views as yours you think Knowledge not always neutral. How *could* it be with such neutrality-laws as you would enjoin?—W. J. Brindle. Your man-servant mistook a dark part of the moon for an eclipse shadow. The mistake has been made before when the moon has been five or six days past the full. "Whitaker's Almanac" naturally did not predict the occurrence, nor as you say did "F.R.A.S." in "The Face of the Sky." The sympathetic inks you describe hardly fulfil Mr. Wood's requirements.—Jas. Walker. We do not undertake to work sums. But here is a general way of working out such problems. Let h be the height of a right cone, V its volume, and v the volume you want to cut off by a plane parallel to the base. (In your case v is V/3 for one section and 2V/3 for the other.) Let x be the distance of the required section from the vertex. Then we have the proportion

$$V : v :: h^3 : x^3$$

whence you find x at once, because V, v, and h are known.—D. Mayer. Your mathematical papers received, and kept for future use. But other matter received earlier awaits insertion. Much obliged to you for it.—E. G. S. So-called spiritualism is associated with so much rascality that I would not care for papers explaining how the tricks are usually done.—H. Jones. (1.) The telescopes are different; but not having seen one of them can express no opinion as to their relative merits. (2.) "The Stars in their Seasons" quite different from "New Star Atlas": the former is constructed especially for England and places in about same north latitude; the latter is an atlas of the whole star sphere, and as well suited for any latitude, north or south, as for the latitude of London. —A New Reader. Thanks for magic square, which I will insert with description. I hope it is not one of those which have already appeared in Knowledge; but really have not time to hunt them all up. This must be the last for the present of magic squaredom.—W. H. Milnes. I am no authority in matters classical; but it seems to me there *is* a rather abrupt change of mood in the motto *Aut nunquam tentes aut perfice*, and that two subjunctives or two imperatives would be better. But I may be quite wrong.—C. H. Marriott. Do not know who is the publisher of Mr. Chimmo's book. A bookseller would be able to tell you.—A. G. Grenfell. Scarcely. Should say advertising might be of use.—Naggdribb. Thanks for cutting with Capt. Delauney's nonsense. Hope the spelling of name correct, and that he is not really a namesake of the eminent Delaunay.—A. Hubble. Thanks, but seldom have room for translations, and when I do I translate them myself.—Perplexed. Probably the difference arises from the way of blowing. The correctness of the law for closed pipes, even with the comparatively rough test you indicate shows that the law is sound enough.—W. N. Huddy. Probably long continued pressure on the eye during sleep had produced a temporary change of shape in the lenses.—A Wellwisher. Very glad the notice led you to a useful little book.—Welshman. Unfortunately do not know how bones may be melted so as to be moulded into any required shape. Should have thought it impossible.—Zer-ubba-bel. Know absolutely nothing about masonic keys, and am therefore unable to explain how the Tau figure is used in measuring the celestial globe. —J. D. Am away from Nautical Almanack, but for your purpose you should use that excellent work. It gives the R. A. of Polaris, and for each day in October (or any other month) you can readily find the time when Polaris is on the meridian either above or below the pole. If we were to solve every such problem which occurs to our numerous readers, we should find time running rather short.—A Subscriber. The question is momentous, and quite in my line as a student of mathematics, astronomy, and so forth:—"*Can* horses breathe with their nosebags on them, filled with chaff and corn?" Your humble opinion is, "that they are then in a state of suffocation"; and "for the last seven years" you have "brought out a ventilating nosebag." (Brought it out where and how?) My humble opinion is that horses, whether full of chaff and corn or not, can breathe and do breathe, with their nosebags on them. I have a curious theory that if they could not breathe they would cease to exist. But perhaps if I had brought out a ventilating nosebag for seven years I should think differently. Are not *you* rather full of chaff, by the way?—W. S.—I quite agree with you that it is a circumstance full of terrible meaning that so many should have applied for that horrible office.

Our Mathematical Column.

MATHEMATICS IN OUR SCHOOLS.*

By Professor Henrici.

PURE geometry seems to me to be of the greatest educational value, and almost indispensable in many applications; but it has scarcely ever been introduced at Cambridge, the centre of mathematics and mathematical education in England.

Geometry and geometrical drawing, which teach how to represent figures on a plane or other surface have been treated as arts unknown at English Universities, and relegated to the drawing office. Instead of this, they ought to be an essential and integral part of the teaching of geometry in connection with the purely geometrical methods. As far as the progress of science is concerned, this neglect of pure geometry in England has been of little consequence —perhaps it has rather been a gain. For science itself it is often an advantage that a centre of learning becomes one-sided, neglects many parts in order to concentrate all its energy on some particular points, and make rapid progress in the directions in which these lie.

But what may suffer, if one side of a science is not cultivated in is the industry which would have gained by its applications. In considering the teaching of any mathematical or other scientific subject, we cannot at the present time neglect the wants of the ever-increasing class of men who require what has been called

* From Prof. Henrici's opening address to the section of Mathematical and Physical Science, British Association.

technical education. Among these, the large number who want mathematics at all require geometry much more than algebra and analysis, and geometry as applied to drawing and mensuration.

The teaching of geometry especially, as judged by the text-books which have come before me, is somewhat deplorable. And this is so, principally, because the spirit of Euclid and the methods of the ancient Egyptians and Greeks, rather than the fundamentally different ideas and methods of modern geometry, still rule supreme; though the latter have had their origin partly in technical wants. In what is called geometrical drawing, or practical geometry, for instance, there are first given a number of elementary constructions—such as drawing parallels and perpendiculars, or bisecting the distance between two given points. They are solved by aid of those instruments only which Euclid knew—viz., the pair of compasses for drawing circles, and the straight-edge for drawing straight lines. But there is no draughtsman who would not, as a matter of course, use set squares for the former problem, and solve the latter by trial rather than by construction. Then again, there come constructions like the division of the circumference of the circle into seven parts, which cannot be solved accurately, but which is very easily solved by trial. Instead of that, a construction is given which takes much more time, and is by no means more accurate. For, after all, our lines drawn on the paper are not without thickness, so that, for this reason alone, every part of the construction is affected by some small error; and it is absurd to employ a construction, though theoretically true for ideal figures as conceived in our mind, in preference to a much simpler one which, within our practical limits, is equally, or perhaps more, correct.

This is very much like the manner in which I found problems on decimal fractions treated by the candidates for the matriculation examination at the London University, and which reflected little credit on the manner in which the important subject of decimals is handled at our schools. It is so characteristic that I may be excused for giving it here. The problem, for instance, being to give the product of two decimal fractions, exact to, say, four decimals, each of the factors having the same number of places, this was almost regularly performed as follows:—First, the decimals are converted into vulgar fractions, then these are duly multiplied, numerator by numerator, and denominator by denominator, and then the resulting fraction is again converted to a decimal, with as many places as it may yield; and, lastly, of these the first four are taken and put down, duly marked "Answer!" Or a candidate (standing, however, on a far higher level) multiplies both decimals out in the proper fashion, but to eight places, and cuts off four places at the end. No wonder that the public at large will hear nothing of the decimal system of weights and measures if the very essence of the decimal system of numbers is so little understood by the men who have to train the minds of the young generation.

It is by the neglect of pure geometry and of its applications to geometrical drawing that Cambridge has lost, or rather has never had, contact with the practical needs of the nation. All the marvels of modern engineering have sprung into existence without its help. The great engineers have had to depend to a degree now unheard of upon costly experiments, until they themselves gradually discovered mathematical methods adapted to their purposes. Only the electrical engineer found ready to his hands a complete theory of which the mathematical part has been to a very great extent developed at Cambridge, or by men who have had their mathematical training there. This theory is, however, in its very nature less geometrical.

The engineer will always prefer geometrical methods to analysis, and has invented for himself a great variety of them. Originally these are disjointed, being invented for special purposes. It is the business of the mathematician afterwards to connect, simplify, and extend them, as has been done to a great extent by Culmann in Zurich, and by Cremona at the Polytechnic School at Rome. Of these methods a few may be mentioned. First of all the geographical determination of stresses in certain girders invented both by mathematicians and by engineers. Its application is so simple that no engineer will ever use any other method if once he knows this one. It is so well adapted to its purpose, that I venture to say that a simpler method is impossible, being fully aware how dangerous such a statement is. Nay, if I were asked to give the formulæ to obtain the stresses by calculation, I should write these down from a sketch of the diagram, this being the simplest way of obtaining them. Another problem which occurs again and again is the determination of the area of a figure representing perhaps a plot of land, or the section of a beam. Here also the advantage is altogether on the side of the graphical method.

It is unnecessary to multiply these examples. But to make full use of graphical methods, the draughtsman ought to have a thoroughly geometrical education.

That the old-established mode of teaching the elements of geometry based on Euclid requires a thorough and fundamental change has been often acknowledged, among others, at Exeter and Bradford, by two of the most eminent mathematicians who have occupied the chair, and besides by the many teachers who constitute the Association for the Improvement of Geometrical Teaching. I have hesitated on entering on this somewhat delicate quesion, because I fear that I have little to offer but criticism, which might seem hostile to the association just named. But I hope that the many earnest workers, who have devoted much time and thought to the drawing up of syllabuses on different parts of our subject will excuse the remarks of one who has himself tried his hand at the same work, and who therefore may be supposed somewhat to know the difficulties that have to be overcome. When the syllabus on the elements of plane geometry appeared, I resolved to give it a thorough trial, and took the best means in my power to form an opinion on its merits, by introducing it into one of my classes. The fact that it did not quite satisfy me, and that I gave up its use again, does not, of course, prove that it fails also for use in schools, for which it was originally intended.

The more I have become acquainted with the difficulty of the whole subject, the greater has become my admiration for Euclid's book, while my conviction of its unfitness as a school book has equally gained in strength. In considering the merits of Euclid as a text-book, it is desirable to distinguish clearly between the general educational value of its teaching and the gain of geometrical knowledge. It is with the latter chiefly that I am concerned, while it is, of course, through the former that Euclid has got so firm a hold at all schools; and to the great majority of boys this is undoubtedly of most importance, and no reform would have the slightest chance of becoming generally introduced which neglects this. But improvement in both directions may well go together, and the logical reasoning employed in Euclid would gain to many boys much, both in clearness and interest, if the subject-matter reasoned about became in itself better understood.

If acquaintance with geometrical objects, particularly through the medium of geometrical drawing and the many methods used in the Kinder-Gartens, were secured, then a systematic course of geometry would become both easier and more useful. Much, indeed, may be done by introducing simple geometrical teaching into the nursery, and into the earliest instruction of children, following the example of the Kinder-Garten, and it is pleasing to see that the latter are rapidly gaining ground in England. It is true that these schools may still be improved. In geometry they seem to, and perhaps at present are bound to, work mostly towards Euclid. But many able men and women are actively engaged in perfecting them, and it is of interest to know that Clifford had it in his mind to write a geometry for the nursery and the Kinder-Garten.

In a curious contrast to the mode of teaching geometry stands that of teaching algebra. In the first, everything is sacrificed to logic. Axioms and definitions without end are given, though to the beginner a more rapid dive into the subject would be much more suitable. In algebra, on the other hand, the boy is at once plunged into the midst of it. No axiom is mentioned. A number of rules are stated, and the schoolboy is made to practise them mechanically until he can perform, and that often with considerable skill, a number of most complicated calculations—but calculations which are often of very little use for actual applications. Simplifications of equations follow in senseless monotony, until the poor fellow really thinks that solving a simple equation does not mean the finding of a certain number which satisfies the equation, but the going mechanically through a certain regular process which at the end yields some number. The connection of that number with the original equation remains to his mind somewhat doubtful. Then there are processes, like the finding of the G.C.M., which most of the boys never have any opportunity of using, excepting, perhaps, in the examination room. A more rational treatment of the subject, introducing from the beginning reasoning rather than calculation, and applying the results obtained to various problems taken from all parts of science as well as from everyday life, would be more interesting to the student, give him really useful knowledge, and would be at the same time of true educational value.

The chief progress in geometrical teaching has to be sought in the introduction of modern ideas and methods into the very elements, and modern teaching ought to take full account of this. In favour of this view I might bring forward the opinions of many teachers and mathematicians from England, as well as from abroad, but I will confine myself to one quotation. Professor Sylvester gives his opinion thus:—"I should rejoice to see mathematics taught with that life and animation which the presence and example of her young and buoyant sister (viz., natural and experimental science) could not fail to impart, short roads preferred to long ones, Euclid honourably shelved or buried 'deeper than ever plummet sounds' out of the schoolboy's reach, morphology intro-

XUM

duced into the elements of algebra — projection, correlation, motion accepted as aids to geometry — the mind of the student quickened and elevated and his faith awakened by early initiation into the ruling ideas of polarity, continuity, infinity, and familiarisation with the doctrine of the imaginary and inconceivable. It is this living interest in the subject which is so wanting in our traditional and mediæval modes of teaching." If from this point of view we now look towards the work of the Association for the Improvement of Geometrical Teaching, the result is not as satisfactory as might have been wished. There is very little of the influence of modern ideas to be found in the different syllabuses which have been published. Even in the one headed "Modern Geometry" there is nothing of the genius of modern thought. The subject-matter is partly taken from modern geometry, but for modern methods one looks in vain. Nevertheless, it is satisfactory to see that the use of the syllabus on plane geometry has spread pretty widely, and it is to be hoped that it will continue to do so.

A thorough reform, in the direction indicated, will be a difficult task, and it will, perhaps, be a long time before it is possible. At present it has not even been settled which series of axioms will ultimately be adopted. Possibly, many attempts have still to be made before a new Euclid finds the material sufficiently prepared for him to raise the hoped-for edifice.

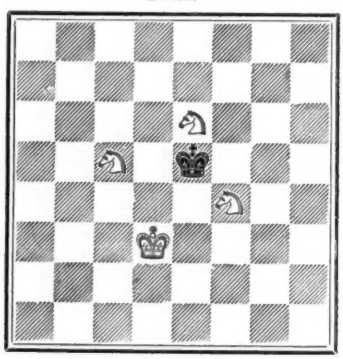
Our Chess Column.

By Mephisto.

PROBLEM.—By the Rev. H. Bolton.

The Arabians.

Black.



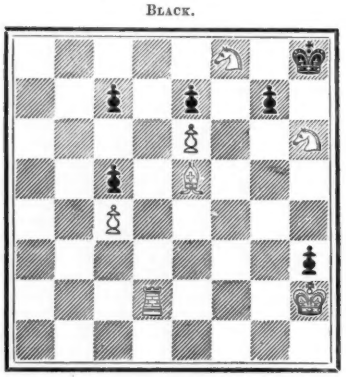
White.

White to play and mate in fourteen moves.

PROBLEM No. 101.

By W. Furnival.

Black.



White.

White to play and mate in three moves.

SOLUTION OF PROBLEM 99.

1. K to KB8. Threatening 2. Kt to Q7 (ch) and 3. Kt (from Kt3) to QB5, mate.

1. Q takes QBP does not prevent this, as the Q will be pinned.

This checkmate position is very beautiful.

Black's defences are Q takes Kt or P takes Kt.

If 1. Q takes Kt. 2. Q to KR2, &c.

If 1. P takes Kt. 2. Q to QR7, &c.

This is doubtless an exceedingly beautiful problem, but there is a slight blemish in the fact that in answer to several of Black's possible *first* moves (viz., P to QR6, P to K7, P to KB6, Q takes Q, Q to B8, Q to Q8, Q to Q7, Q to K7, Q to KB7, Kt to R6, Kt to Q7) White can play either 2. K to K7, or 2. Kt to Q7 (ch). Fritz's problem, however (unnumbered, on page 64), has some dual solutions on the second move. I do not think No. 99 bears away the palm from Fritz's composition. In the former the White K is evidently *wanted* on K7, and the fact that he must not travel by KB7 suggests KB8. In the latter, KR8 is apparently such a useless position for the Queen that one is hardly likely to try it until it is suggested by the failure of Q to KR6 and Q to KR4. The almost exact balance of pieces is also a point (though a small one) in favour of the first prize problem. But the ideas and combinations in both are so elegant that the only reason why Berger's problem is not the best, is that Fritz's is such an uncommonly fine problem. The similarity in the methods of getting the White Q round an awkward corner will not pass unnoticed. W.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

J. A. Miles.—Problem received with thanks.

Correct solutions received.—Problem 99, John Watson. No. 100, W., B. Gleam, John Watson.

John.—In Problem 99, if 1. Q takes Q, Kt to B6 (a very fine defence). 2. Kt to R5, Kt to Q4. Or, 2. Q takes Kt, P to B6, and there is no mate.

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